Supplementary Information for

The effect of mass shootings on daily emotions is limited by time, geographic proximity, and political affiliation

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Supplementary information text
Figures S1 to S10

SI Text

The supplementary materials describe several additional tests conducted to (1) gauge the robustness of the findings presented in the main text, (2) examine heterogeneity of treatment effects, and (3) compare the effect of mass shootings to other salient cultural and political events.

1. Robustness Checks

A. **The number of interviews conducted before versus after a mass shooting**. The central assumption of the analysis is that the relative timing of interview assessments and mass shootings is exogenous among individuals who live in the same location. One threat to this assumption is the possibility that a mass shooting affects the interview schedule, and reduces the number of respondents interviewed in the immediate aftermath of the incident. To test this possibility, we model the daily number of interviews conducted in the same city or state where an incident occurred, using the same before-after specification in the main analysis and controlling for time and location fixed effects. Figure S1 presents the estimated effects of a mass shooting on the number of interviews conducted over a four-week period after the incident and with a 90% confidence interval. In comparison to the average number of daily interviews conducted in the four weeks before a mass shooting, there is no change in the number of interviews conducted immediately after the event.

B. **Respondents' characteristics before vs after a mass shooting.** A second threat to the exogeneity assumption is the possibility that a mass shooting affects the composition of respondents who are interviewed in the immediate aftermath of the incident. We model respondents' socio-demographic characteristics in the same city or state where an incident occurred, using the same before-after specification in the main analysis and controlling for time and location fixed effects.[1] Figure S2 shows no significant or meaningful difference in race, education, marital status, gender, age and the number of kids in the household among respondents interviewed in the four weeks after versus before a mass shooting, other than anomalous point estimates that are likely to represent noise. We controlled for these socio-demographic characteristics in the main analysis to account for any observed difference in the composition of individuals interviewed before and after the incident. Figure S2 also reveals that, in the first few days after the event, respondents are significantly more likely to self-identify as Republican at both the city and the state level and are significantly less likely to self-identify as Democrat at the state level. There are two ways to interpret this finding. One is that it is statistical noise. A second is that self-identified Republicans are more likely to participate in interviews while self-identified Democrats are more likely to opt out of interviews in the days immediately after a mass shooting. Given the finding that Democrats show a greater emotional response to mass shootings, this would suggest that our results showing the overall impact of mass shootings may be underestimated in the main analysis. In other words, if our assumption of exogenous variation in the relative timing of incidents and interviews is violated, it would mean our results may be biased toward zero and the true impact is likely to be larger than reported in the main text.

C. **Alternative specifications.** Our main specification compares the emotions of respondents interviewed during day d-1 to day d+1 after a mass shooting to those interviewed in the four weeks

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[1] Because age is in very different scale from the rest of the variables, we model the standardized age.

before a mass shooting in the same city or state where the event occurred. In this section, we use an alternative specification that models the temporal change in respondents' emotions from 28 days before a mass shooting to 28 days after the event in the same city or state where the event occurred. The goal is to assess whether there is any evidence of a trend in emotions before a shooting, and to show the sharp change afterwards.

We estimate the following equation:

$$Emotion_{ipt} = \beta_0 + \beta_1 After_t + \beta_2 Before\_after_t + \beta_3 Dayssince_t + \beta_4 Dayssince_t{}^2 + \beta_5 Dayssince_t{}^3 + \beta_6 Daysbefore_t + \beta_7 X_i + \gamma_t + \sigma_p + \epsilon_{ipt},$$ [1]

where $Emotion_{ipt}$ denotes a vector of dummy variables measuring whether the respondent i, interviewed at time t in location p, experienced sadness, anger, happiness, or smiling/laughing a lot yesterday. $After_t$ is a dummy variable that equals one for respondents who lived in the same location as the shooting and were interviewed during the four weeks after the event. $Before\_after_t$ is a dummy variable that equals one for respondents who lived in the same location as the shooting and were interviewed during the four weeks before or after the event. For respondents interviewed during the four weeks after the event, $Dayssince_t$ is equal to the number of days passed from the mass shooting date to the interview date. For other respondents, $Dayssince_t$ is equal to zero. For respondents interviewed during the four weeks before the event, $Daysbefore_t$ is equal to the number of days passed from the interview date to the mass shooting date. For other respondents, $Daysbefore_t$ is equal to zero. X_i denotes a vector of socio-demographic characteristics of the respondent. γ_t denotes a vector of year, month, and day of the week fixed effects. σ_p denotes the fixed effects of the location where the shooting occurred. The locations are cities/towns for the city-level analysis and states for the state-level analysis. ϵ_{ipt} is the error term. This alternative specification allows us to model the linear trend in emotions in the four weeks before a mass shooting and a cubic trend in the four weeks after the event.

Figure S3 shows the temporal trend in emotions from 28 days before a mass shooting to 28 days after the event. Overall, we did not find a significant or meaningful linear trend in emotions prior to mass shootings for any set of analyses. Consistent with the findings in the main text, mass shootings lead to sharp but short-lived changes in sadness, anger, happiness and smiling/laughing at the city level. The immediate changes in emotions after an event are much smaller at the state level. Lastly, Republican respondents living close to the shooting have a smaller change in emotions immediately after the incident than Democrat respondents.

D. **Robustness across three mass shooting datasets.** The analysis in the main text is based on 31 incidents with at least four fatalities and identified in all three databases that independently track mass shooting incidents over time. Figure S4 shows the robustness of our main findings at the city level across three datasets. The analysis is based on 37 incidents from the FBI Active Shooter Study, 43 incidents from the Violence Project and 55 incidents from the Stanford Mass Shootings of America dataset, respectively.

The pattern of findings is extremely similar across three datasets. This is driven in part by the fact that some incidents are in all three datasets, but this is only a partial explanation for consistency of findings. Of the 66 incidents defined as a mass shooting by any of the three datasets, 28 were

only identified in one dataset and 7 were identified in two datasets. Given the different choices about incidents that count as a mass shooting, the similarity in findings regarding the effects of such events is notable. In each dataset, the effects of mass shootings on sadness, anger, happiness, and smiling/laughing are strong in the day after the event, and fades quickly. Only effects on smiling/laughing persist for several weeks after the event.

2. Heterogeneity in Treatment Effects

A. **Effects by respondent characteristics.** In the main text, we examined the effect of mass shootings by respondent's political affiliation. In this section, we explore whether effects vary by other characteristics of respondents. To do so, we replicated the main analyses at the city and state level, using stratified samples of respondents by gender and race, respectively. These analyses make comparisons among individuals of the same gender/race who live within the same location where a mass shooting has occurred.

Figure S5 shows no clear evidence of heterogeneity in impact by respondent race, although it is difficult to make strong conclusions because estimates are imprecise due to the relatively small sample of Black respondents. At the city level, White respondents have stronger immediate responses to mass shootings in anger, happiness, and smiling/laughing than Black respondents, but Black respondents have stronger responses for the measure of sadness. At the state level, Black respondents are substantially less likely to feel happy on the day after mass shootings than White respondents, but looking across all outcomes there is no clear pattern of heterogeneity by respondent race. Figure S6 shows suggestive evidence of heterogeneity in impact by respondent gender. At the city level, men had substantially stronger responses to mass shootings than women, particularly for anger and smiling/laughing. There is no substantial gender difference at the state level. Overall, we are limited in the conclusions we can make from these analyses because of the imprecision of the estimates.

B. **Effects by incident characteristics.** We conducted two additional analyses to examine the extent to which emotional responses to mass shootings differ by incident severity and the race of the shooter. Figure S7 presents the results from the main analyses, when we only include the deadliest third of the mass shootings. These incidents had at least ten fatalities, excluding the shooter. The estimated effects are less precise because of the small sample, but do show that the impact of these more extreme events is felt more broadly outside of the city or town where the incident took place. However, the duration of the impact is similar to an average mass shooting.

Figure S8 presents the results from the main analyses, when we only include mass shootings committed by White shooters or Black shooters respectively. Again, we are constrained in reaching strong conclusions because of the imprecision of the estimates. However, there is suggestive evidence from models at the city level that the emotional impact of a mass shooting is larger if the shooter is Black. This finding is not as clear at the state level.

3. The Emotional Impact of Other Salient Events

To provide a point of comparison for the effect of mass shootings, we examined the impact on emotions of some of the most salient cultural and political events in American society: the NFL Super Bowl from 2008 to 2016 and the presidential elections in 2008, 2012, and 2016.

A. **Super Bowl.** To estimate the effect of the Super Bowl, we model the daily emotions in the cities or states whose football team played in the Super Bowl from 2008 to 2016, using the same before-after specification in the main analysis and stratified by winners and losers. The estimated effect of the Super Bowl wins and losses is identified by comparing the emotions of individuals interviewed at different periods of time after the Super Bowl to individuals in the same city/state who were interviewed in the four weeks before the Super Bowl, with controls for respondent socio-demographic characteristics, as well as the day of the week, the month of the year, and the year in which the interview was conducted. Figure S9 shows that Super Bowl wins and losses have an impact on respondents' emotions that are less consistent, and usually smaller in magnitude, than the impact of mass shootings at the city level. At the state level, an average mass shooting has half of the immediate impact of losing the Super Bowl on sadness but aroused more anger. The impact of mass shootings on daily emotions lasted longer than the Super Bowl at both the city and state levels.

B. **Presidential elections.** To provide another comparison we then looked at the effect of the presidential election results in 2008, 2012, and 2016 separately by the political affiliation of respondents. For each presidential election, the estimated effect is identified by comparing the emotions of individuals interviewed at different periods of time after the election to individuals interviewed in the four weeks before the election throughout the nation, with controls for respondent socio-demographic characteristics, as well as the day of the week, the month of the year, and the year in which the interview was conducted. In all three elections, respondents who identify with the losing political party showed a strong response across all four emotions, but the duration of the impact was very similar to the duration of the impact of mass shootings. The effects of presidential election results were typically not significantly different from zero beyond one week. One exception is the 2016 presidential election, which had an impact on sadness among respondents who identified as Democrats that extended beyond one week.

Our conclusions from these analyses are as follows: a) the magnitude of the impact of mass shootings is comparable to or larger than some of the most salient cultural and political events in American society; b) most respondents move on quickly from any public event that does not directly affect individuals or their immediate networks and friends.

SI Figures

Figure S1: The effect of mass shootings on interviews conducted
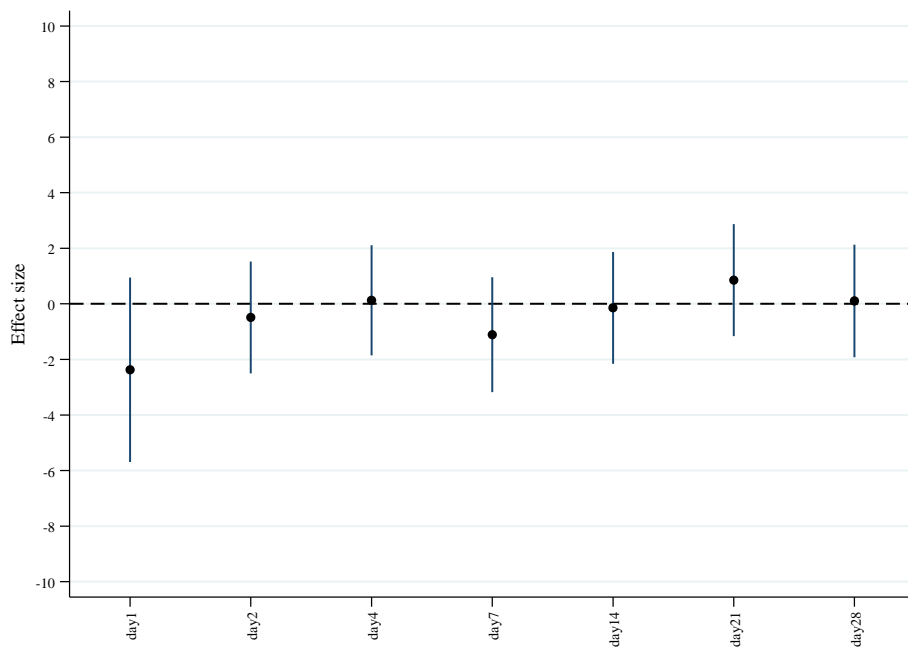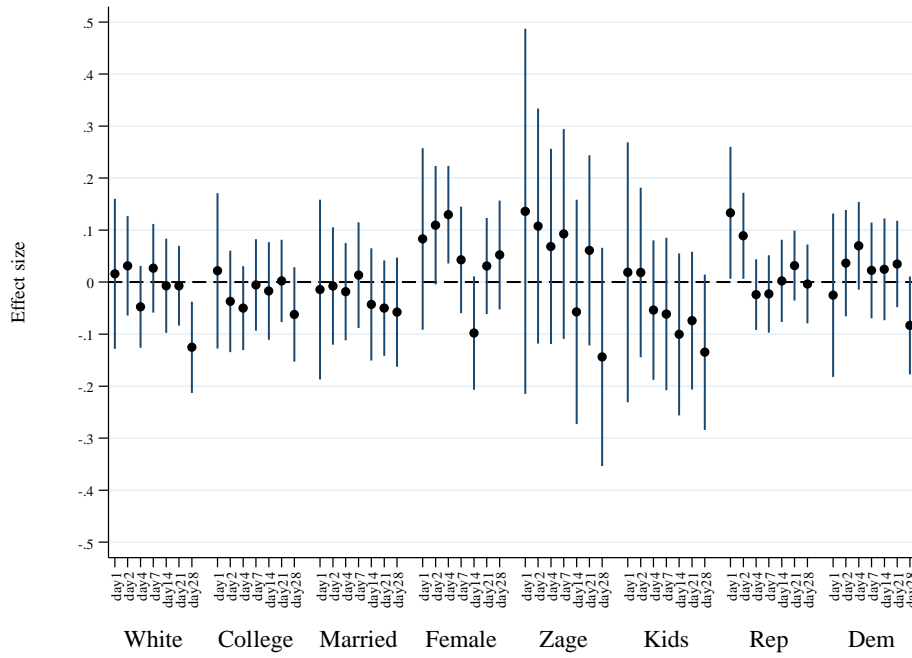
(a) City level
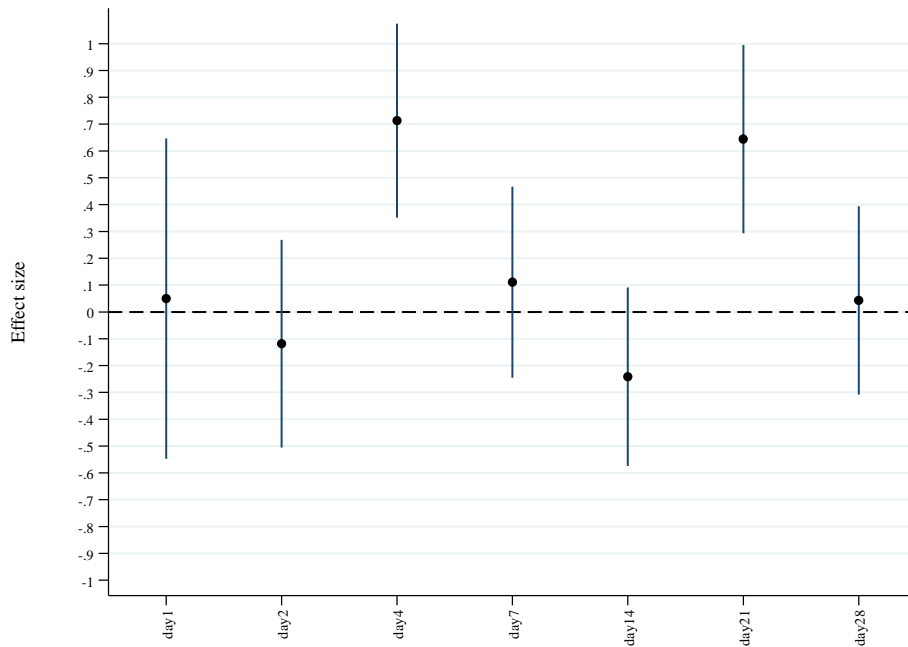
(b) State level

Figure S2: Respondent characteristics after mass shootings
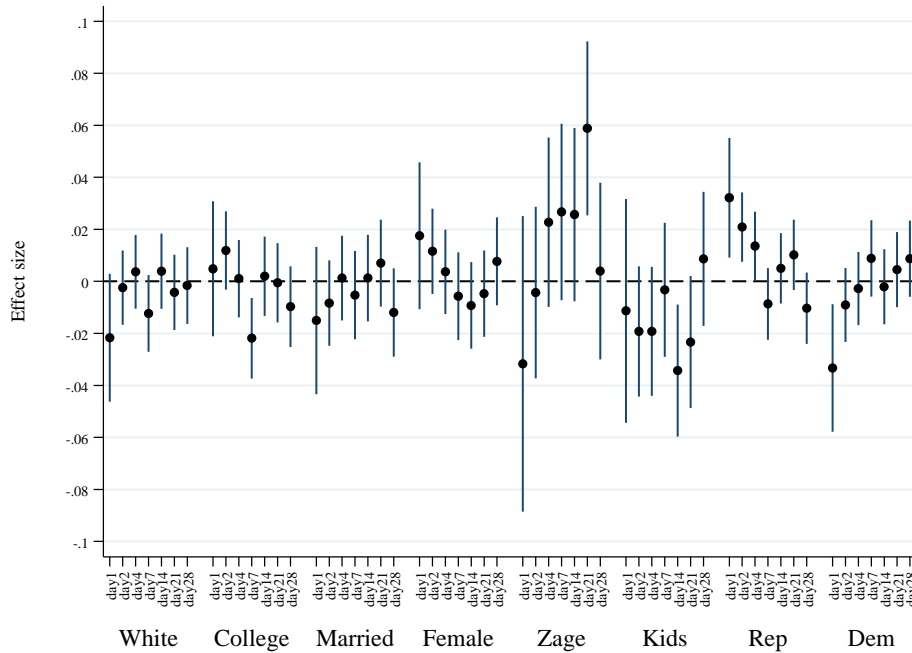
(a) City level

(b) State level

Figure S3: Estimated trends in daily emotions in the four weeks before and after mass shootings
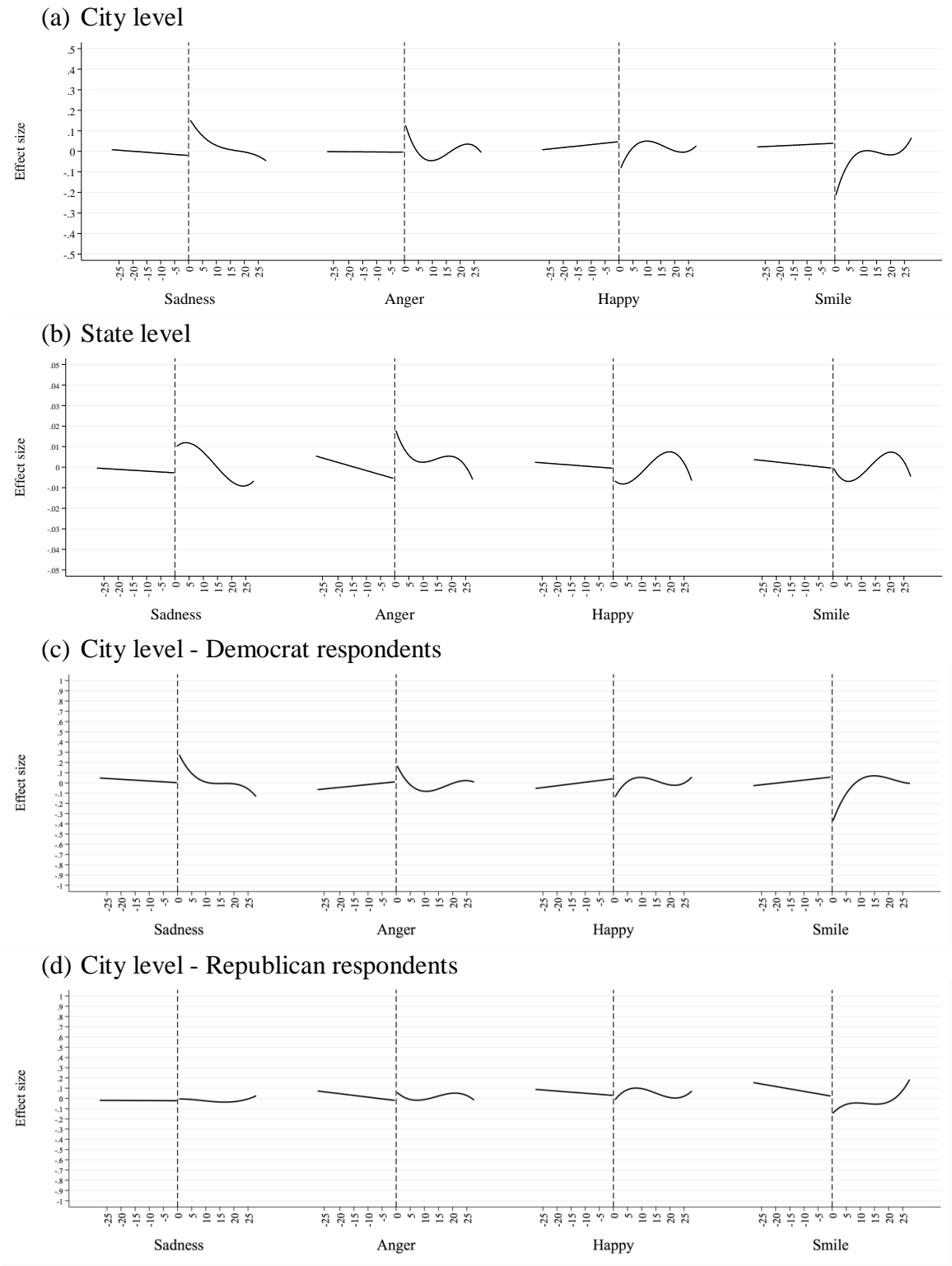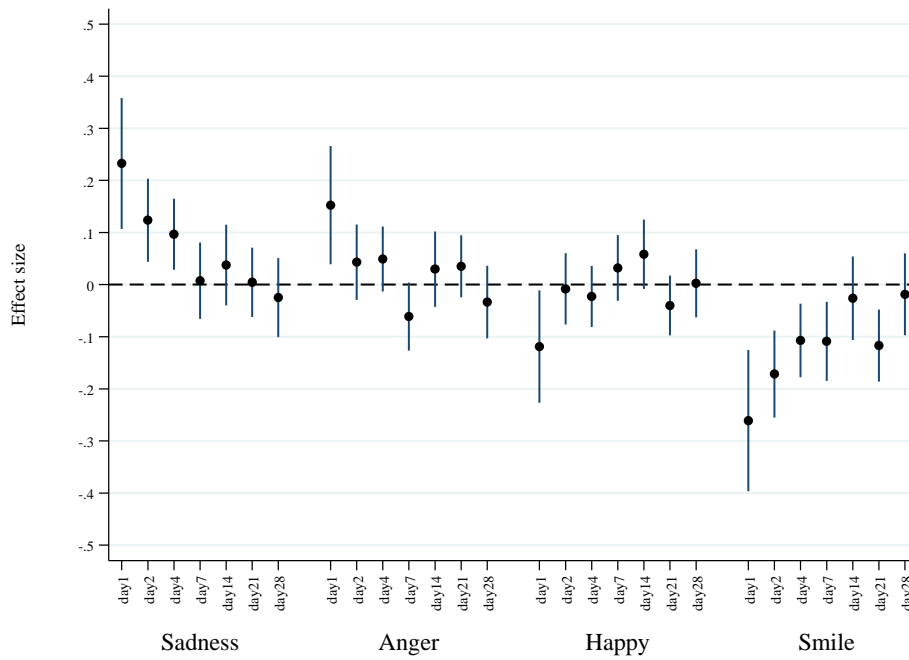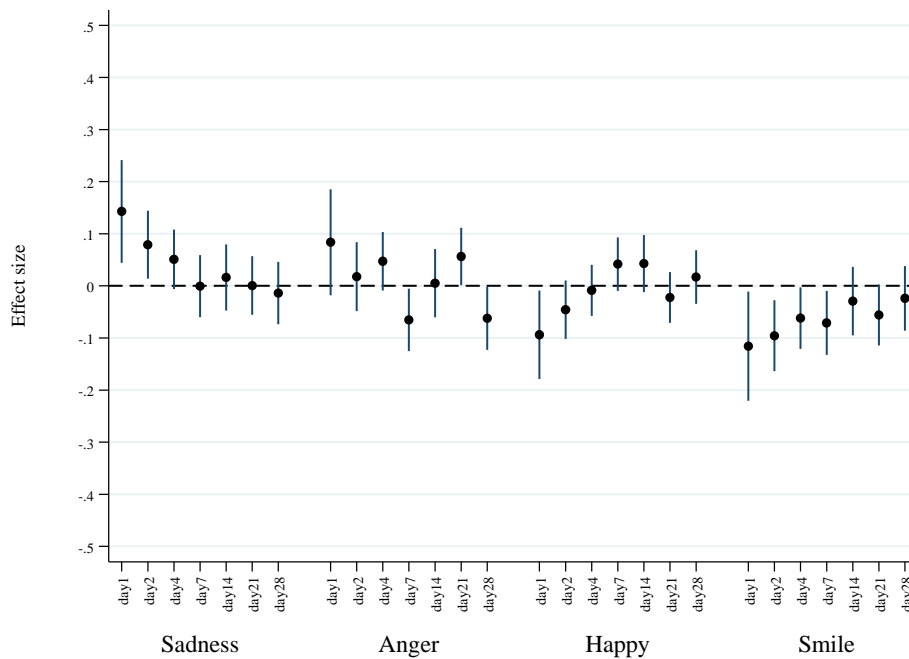
(a) City level

(b) State level

(c) City level - Democrat respondents

(d) City level - Republican respondents

Figure S4: Main analysis using incidents from three mass shooting datasets individually

(a) Active Shooter Study

(b) Stanford Mass Shooting of America

(c) Violence Project
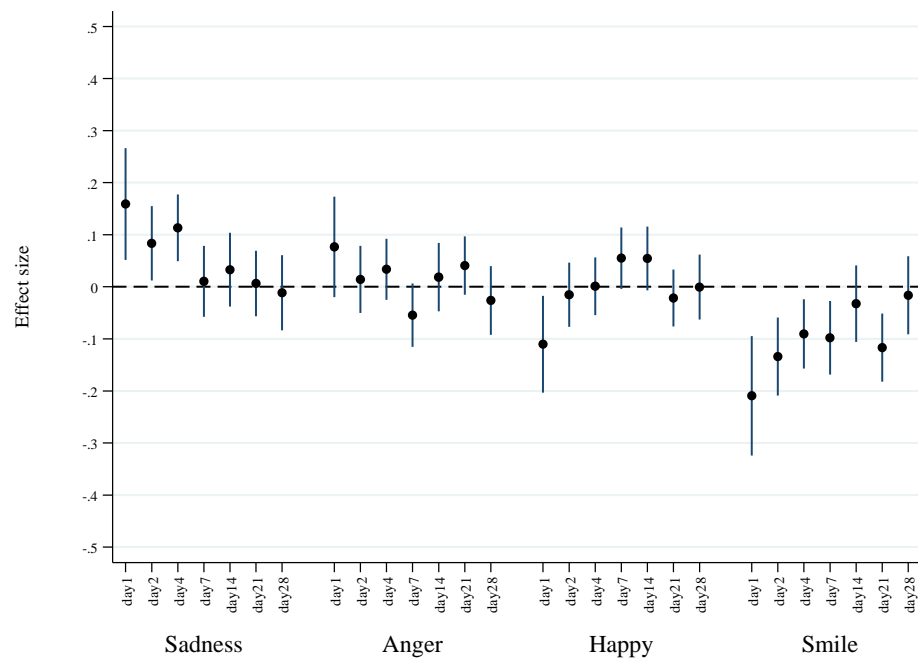
Figure S5: The effect of mass shootings on daily emotions by respondent race

(a) City level
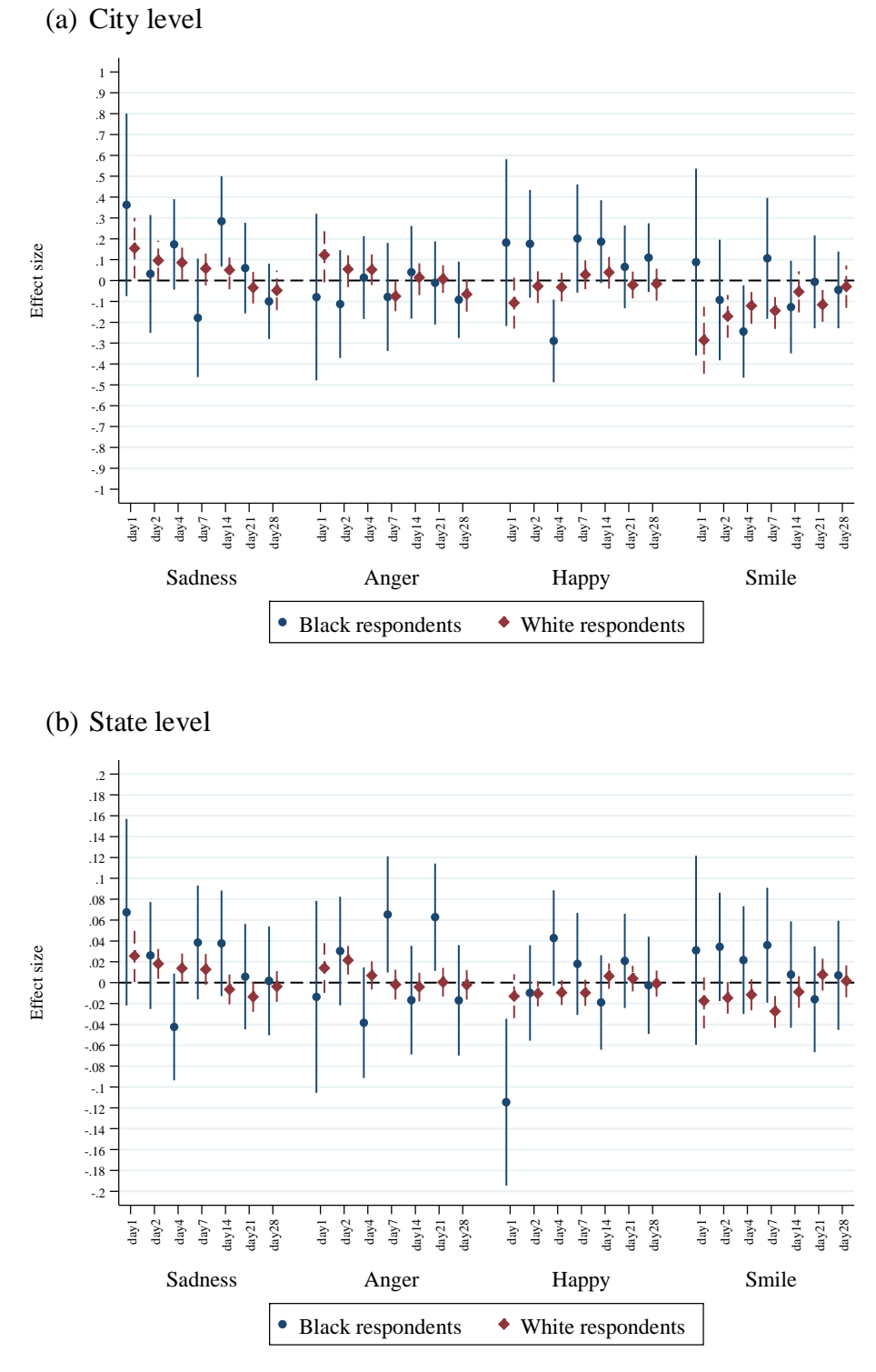
(b) State level

Figure S6: The effect of mass shootings on daily emotions by respondent gender

(a) City level
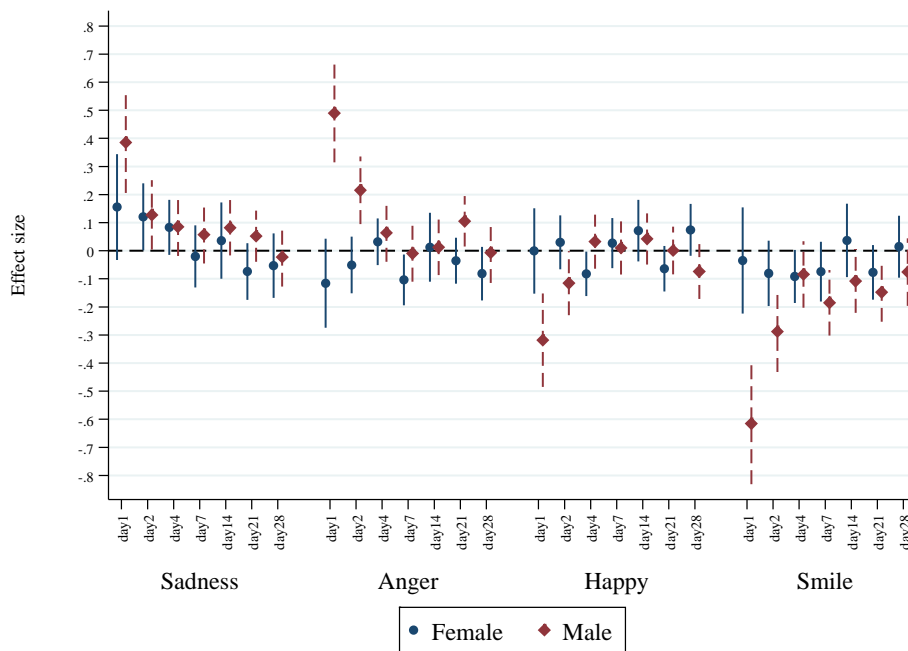
(b) State level
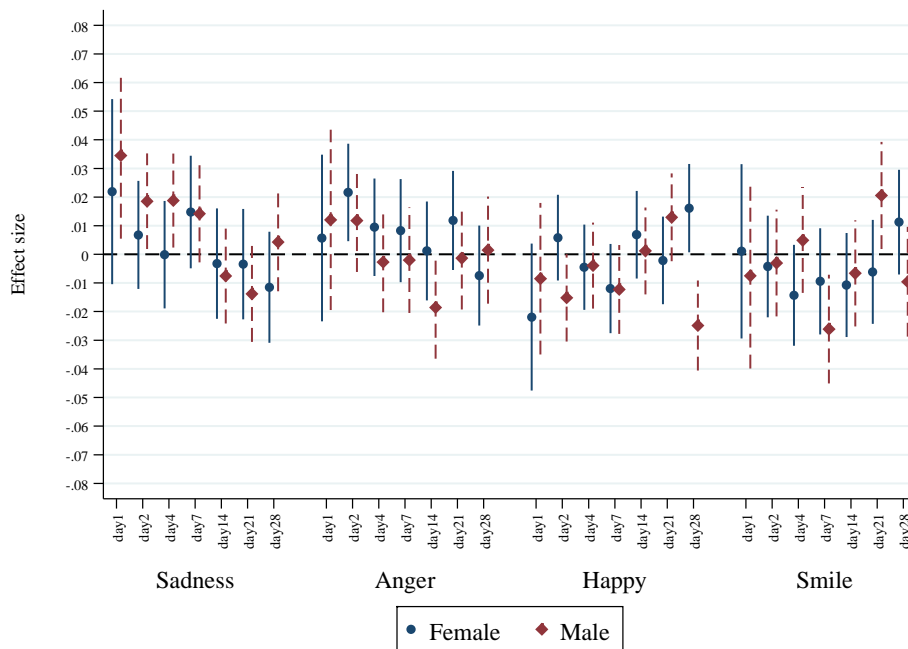
Figure S7: The effect of the deadliest mass shootings on daily emotions

(a) City level
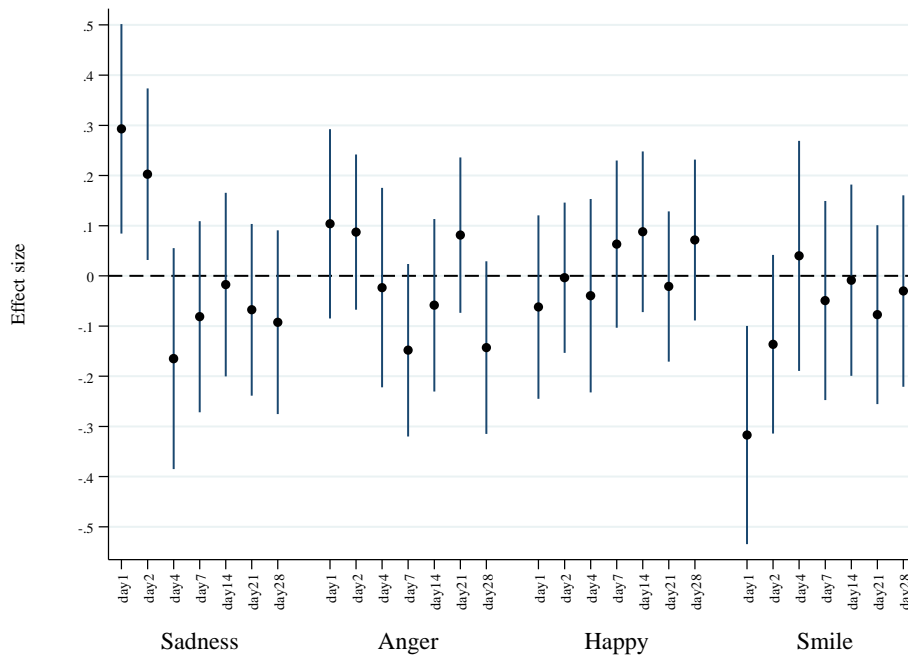
(b) State level
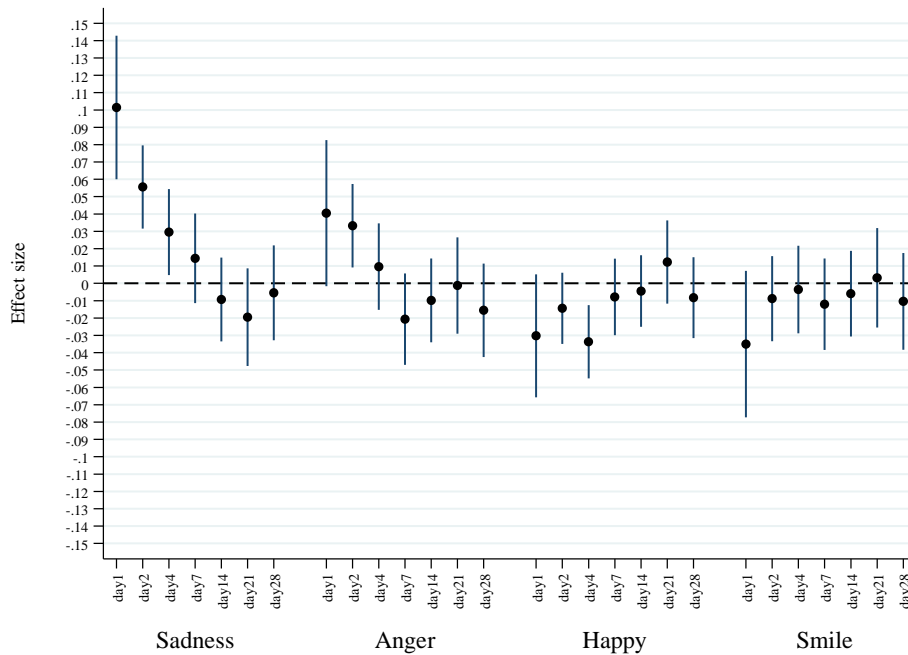
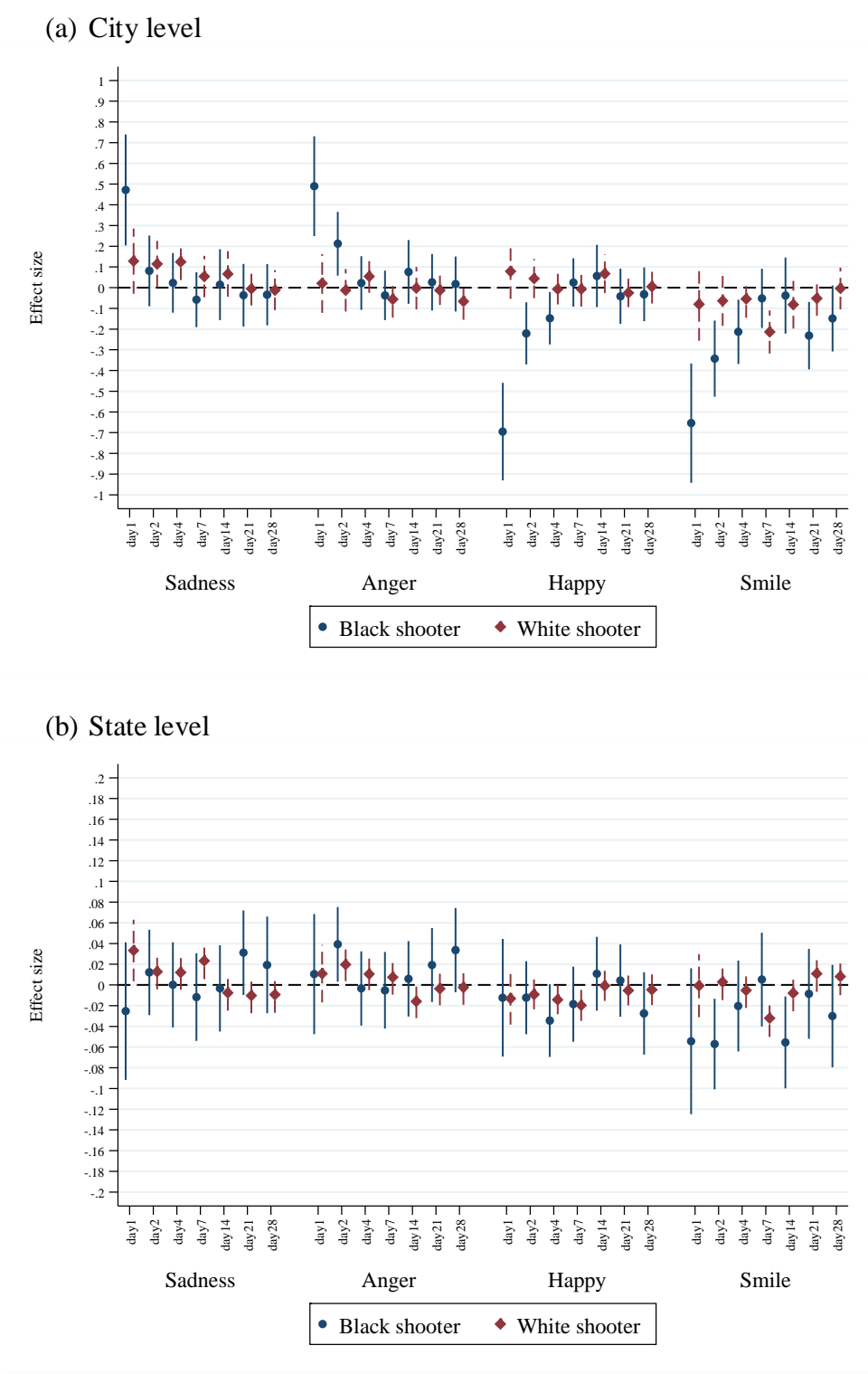Figure S8: The effect of mass shootings on daily emotions by shooter race

(a) City level

(b) State level

Figure S9: The effect of the Super Bowl on daily emotions
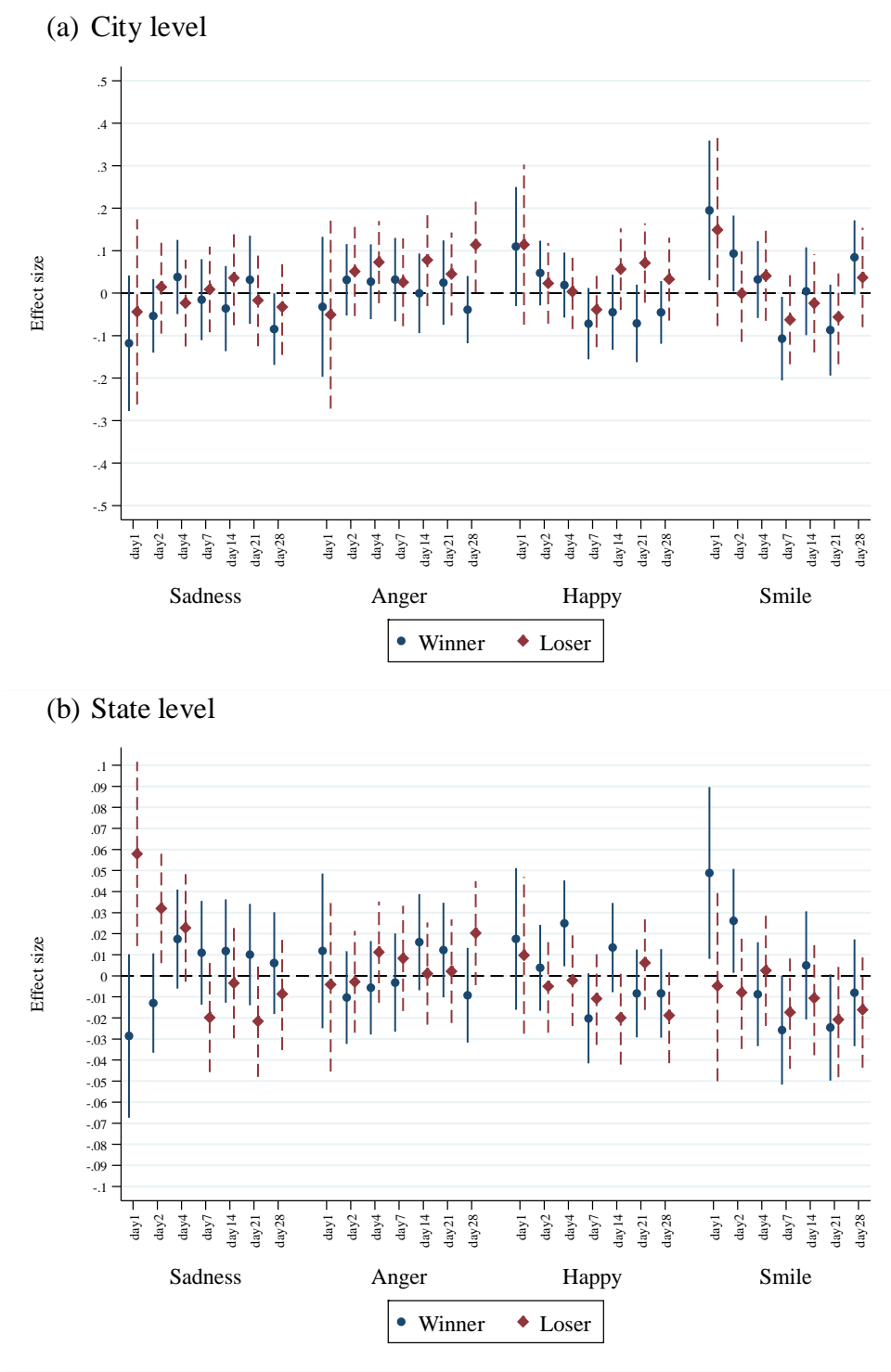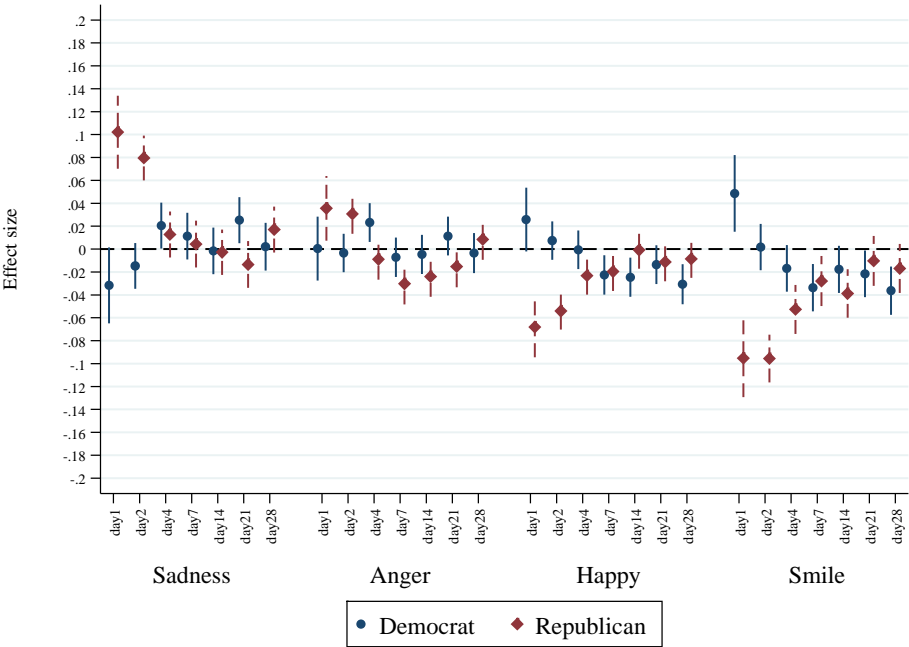
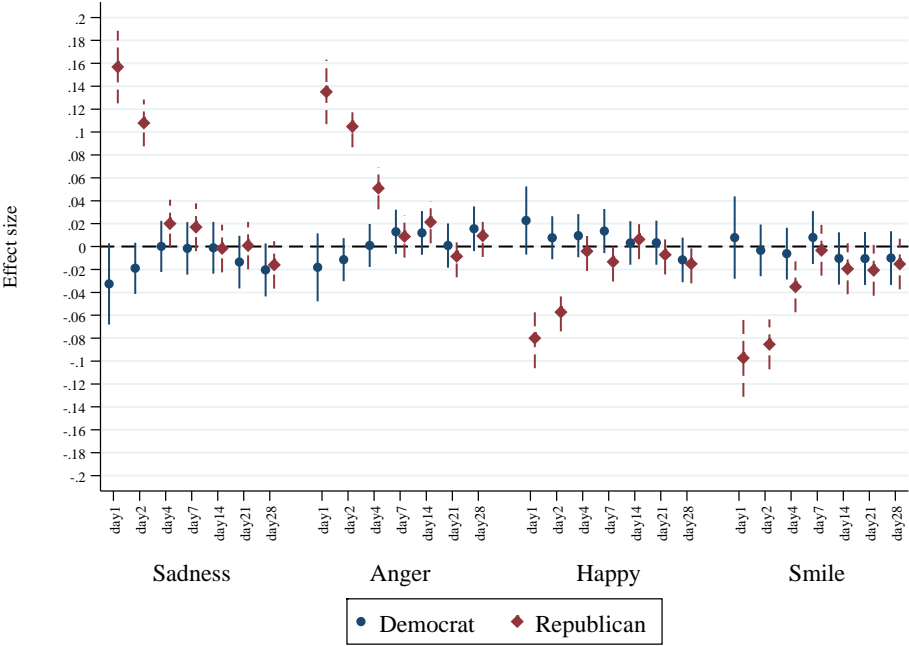(a) City level

(b) State level

Figure S10: The effect of presidential elections on national daily emotions

(a) 2008 presidential election

(b) 2012 presidential election

(c) 2016 presidential election